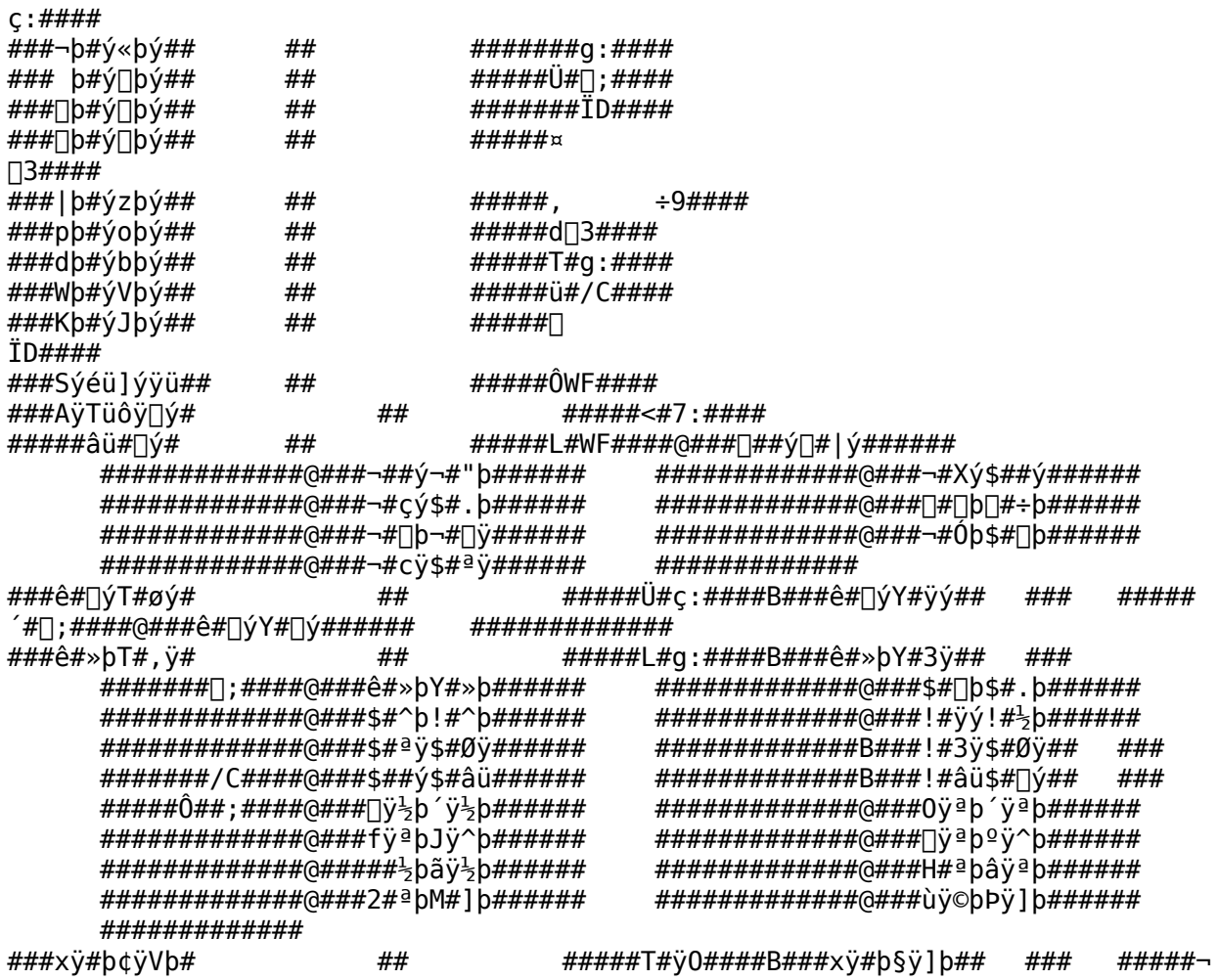

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#ÿÿ####ÿÿ#####ÿ#ÿÿd#########d#########r###Naval Surface Warfare Center Electrical Systems Department (Code 813)Annapolis, MD 21402-5067Tel: (410) 293-9495

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ë#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d############Demonstrate Advantages of Applying Advanced Power Semiconductor Devices (i.e. PEBB) to the Navy□s Auxiliary Machinery ApplicationsProvide Feedback to ONR□s Advanced Semiconductor Development Program (PEBB-2, PEBB-3)Part of NAVSEA□s PEBB Concurrent Engineering Process#

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For this program these are the potential PEBB applications for auxiliary machinery. Each phase of the program will attempt to address as many of these as possible, although to different degrees - function only in phase 1, form/function in phase 2 and form/fit/function in phase 3. Ultimately the number of different form/fit combinations needed will be driven by the range power level and power quality reqs.

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A#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#########□###Phase 1 - Brassboard Demonstration
(FY96-97)Phase 2 - Land Based Test Site (LBTS) Demonstration (FY97-98)Phase 3 -
Shipboard Demonstration (FY98-00)

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############ÿ□#ÿÿd#########d##########2##□##«#□ü□
      E##############ÿ□#ÿÿd#########d#########¨###PHASE 3 - SHIPBOARDFully
Multi-FunctionalSoftware Reconfigurable OnlyModularFull Application Packaging
Design & FabricationUtilize PEBB-3Mil-Spec Power Quality
```

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#######d#########2##□## ö□ü□üE##############ÿ□#ÿÿd#########d#########¦###PHASE 1
- BRASSBOARDMulti-FunctionalHardware/Software ReconfigurableModular50 KW
ApplicationsUtilize PEBB-1Provide Feedback for PEBB-2 Mil-Spec Power Quality
```

#"#########"##### ###########"#########"####ÿ□#ÿÿd#########d#########2##□##¡õLü\ ##ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#########þ###Demonstrate PEBB Based Power Converter which is Multi-Functional, Reconfigurable, and Modular Determine PEBB-1 (N-MCT) Limitations at 50kW ApplicationsUtilize Soft-Switching TopologyAchieve Mil-Spec Power QualityFeedback Design Information for PEBB-2

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ÿß#ÿÿ####ÿÿ#####ÿ#ÿÿd#########d#########®###   Hardware/Software Reconfigurable
Minimize Hardware Changes - Buswork    and Filtering  Capable of Parallel
Operation for All Power    Conversion Types#
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Phase 3. will demonstrate the multifunctionality of a single hardware unit via software reprogramming. As indicated earlier, in order to address the entire range of auxiliary applications power level/quality reqs, more than one PEBB design may be needed. While the core program would use one piece of hardware (one for each power level/quality breakpoint) and demonstrate it sequentially in multiple applications, an ATD might be in order to simultaneously demonstrate several identical pieces of hardware in a variety of applications onboard a ship.

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ÿ##ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#########³###A PCL operates by switching its resistance from low to high The fault current causes the polymer to heat-up to its glass transition temperature which causes the resistance switch#

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ÿ£#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#########â###The fault current is limited in less than 500 microseconds The fault current is limited to significantly less than a fuse would allowProtects the semiconductor and allows safe turn-off Capable of multiple interruption cycles

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LOCKHEED MARTIN: DESIGN OF ARCP PHASE SPCO   LEG MODULES &
APPLICATIONS BRASSBOARD

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For Phase 1. (and possibly phases 2 & 3 as well) these are the anticipated players and their respective roles. Using the existing Lockheed Martin IPS contract is both a convenient way to contract the people most familiar with the ARCP and a way to facilitate concurrent engineering of the PEBB for IPS applications. The exact division of effort between the three is not nailed down, but will become clearer as we get into execution. For example, the PLM design effort will be impacted by the performance characteristics of the devices that Harris delivers. Also, it is not certain how much, if any, hardware can be obtained via the IPS contract. As things evolve, we may also want to get other Navy or commercial hardware contractors into the PEBB concurrent engineering process. A series of meetings with Harris and the Lockheed Martin team members in the near future will help to solidify the approach, schedule and cost estimates.

#####D#"#¨#########################2##□##õùxÿ##Z
ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#############PEBB-1 guidelines: soft-switching topology (essential to high freq for PEBB and safer for PEBB-1 N-MCT□s) multi-functional demo at power level capability of PEBB-1 brassboard Approached with intent to minimize h/w and s/w development req□d to demo the range of applications and to provide incremental results in order to maximize PEBB-2 feedback. - reconfigurable brassboard using set of basic building blocks - ARCP phase leg module (PLM) building block based on PEBB-1 N-MCT HTP modulette - build up from least to most complex functions (eg. from single to multiphase and from inverter to rectifier to ac/ac) - one brassboard unit fixed topology (3-phase bridge) with programmable function, second unit reconfigurable h/w & s/w for alternative topology and controls#

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s#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#########5###MIL-STD-1399, Section 300A,
Interface, Electric Power, AC MIL-STD-1399, Section 390, Interface, Electric
Power, DC, SubmarinesPPD 802-6335721, Interface, Electric Power, DC, SSN-21MIL-
STD-461 and 462, EMI Emissions and SusceptibilityMIL-E-917, Electric Power
EquipmentNavy Application Stress Limits Tableÿ

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¸#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#########^###Defined Brassboard Application
RequirementsAwarded Brassboard Development Contract to Lockheed-Martin/SPCO
Preliminary Design: CompleteDetailed Design: UnderwayPLM Controller
CommunicationsComponent Design and Procurement: UnderwayPower Components
Mechanical Parts Controller HardwareCompleted Preliminary Outline of Navy□s Test
System Design

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      s#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#########C###Availability of PEBB-1 (N-MCT)
Modules and Specification SheetsPreliminary Specifications - ASAPPEBB-1 N-MCT
Module Specifications - Sept 96PEBB-1 N-MCT Modules - Oct 96Quantity of Modules
Available for ProgramCommunications Protocol for SMCS InterfaceExtent of the Use
of MIL-E-917 (Component Selection and Derating)#
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